



DIGITAL CLINOMETER

**GeoClino**

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**USER'S    MANUAL**

# CONTENT

FCC Compliance Statement.....	2
SAFETY INSTRUCTIONS.....	2
Read the instructions carefully .....	3
PACKING LIST.....	3
MAIN FEATURES.....	3
WATER-TIGHT .....	4
NAMES OF PARTS.....	5
BEFORE USE.....	6
Placing batteries.....	6
Life of batteries .....	7
POWER-ON AND -OFF .....	7
MODES OF MEASUREMENT.....	8
There are three modes of measurement.....	8
How to use GeoClino in each mode.....	8
Saving the data in memory .....	12
Checking the data in memory.....	13
Fixing the alphabet code in memory .....	13
Simplified direction indicator .....	14
Displaying present latitude and longitude. (GeoClino-G only).....	15
Transferring the data to your computer using GeoAssist software, which comes with GeoClino.....	15
SETTING OF MENUS.....	16
Operation in common .....	16
List of Menus.....	16
Switching modes of measurement.....	17
Calibration.....	18
Other settings .....	24
TECHNICAL INSTRUCTIONS (COMMUNICATION).....	30
Setting for communication.....	30
List of commands.....	31
Data format .....	31
TECHNICAL INSTRUCTIONS (FAQ).....	32
What is the basic principle of measurement?.....	32
Explain about the necessity of calibration.....	34
Does shaking of GeoClino at the time of measurement affect the values obtained?.....	35
IF SOMETHING LOOKS WRONG.....	36
SPECIFICATIONS.....	36
USER SUPPORT .....	37

## FCC Compliance Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### Warning

Change or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.



This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Model Number: GC001U-MS  
Trade Name: GeoClino  
Responsible party: Miners Incorporated  
PO Box 1301 Riggins, ID 83549-1301 USA  
Tel 208-628-3247

## SAFETY INSTRUCTIONS

First read the following safety instructions to ensure your own safety and to protect your device.

### ■ PICTURE SIGNS READ

 <b>WARNING</b>	Fatally dangerous. It can cause death, or grave injury.
 <b>CAUTION</b>	Very dangerous. It can cause serious injury or damage of your device.

### FOR SAFETY



### ◆ Never disassemble or remodel.

There is a danger of fire or electric shock.

**◆Do not use under extreme conditions.**

Do not use under 0°C or over 50°C. Do not use in very humid place. There is a danger of fire or electric shock.

**◆Caution for the place.**

Do not leave in very humid place or within the steam flow.

Do not leave in a car tightly closed under direct sun shin, where the temperature might be very high. There is a danger of fire or breakdown of the device.



**◆Do not place in proximity to strong magnetized things.**

Precise measurement might be impossible.

### BATTERIES

Two AA type batteries are needed to use this product. Purchase them before use.

## Read the instructions carefully

We have no guarantee for any possible damages or lost of data during the time of measuring or saving the data. We have no responsibility for any lost of data during repair.

## PACKING LIST

The pack contains the followings. Check it before use.

- GeoClino.....1
- Serial cable for specially designed for GeoClino....1(\*)
- CD-ROM of application .....1
- Warranty certificate .....1

## MAIN FEATURES

**◆You can measure strike and dip in a single action.**

You only place GeoClino on the bedding plane and see the readings on display. Working time is greatly reduced. You do not need to wait for settling of the needle as in a conventional compass. Very effective for collecting a great number of data.

**◆You can measure trend and plunge of a lineation very easily.**

You get also the strike and dip of the plane on which the lineation lies.

**◆You can save the data in memory by a single action of pressing a button.**

Up to 999 data sets are saved in memory. You can retrieve the data anytime.

**◆It is water-tight.**

You can use the device safely in fields and in all weathers.

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**◆It is provided with calendar function.**

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Your data will be attached with the date when saved in memory. If you have date-bearing GPS data, you can register a geographic location automatically.

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**◆You can transfer the data to your computer.**

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You can send the data to your computer connected with a serial cable. Data handling is so quick and easy. The data transferred can be displayed by symbols on maps. This sequence of works is done using “GeoAssist”, an attached mapping software. It is also possible for this software to make a simplified geologic map.

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**◆A ruler on the lower margin.**

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An orange-colored broken line on the lower margin of the device is used as ruler in cm.

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**◆Simplified direction indicator(digital) with 16 directions.**

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Simplified direction indicator (digital) in 16 directions, N, S, NE, NNE etc. is attached.

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**◆Adjusting for magnetic declination.**

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Adjusting for magnetic declination can be done. Adjusted values are shown when already adjusted.

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**◆Geographic coordinates obtained with the measurement (※GeoClino-G only).**

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GeoClino-G with built-in GPS.

Geographic coordinates (latitude and longitude) of the measuring location are obtained when measuring strike and dip or trend and plunge. Of course you can save them in memory.

## WATER-TIGHT

JIS 6th class of water protection is adopted.

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**◆Usable in wet conditions**

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You can touch the device with wet hands. You can use in rain or by rivers.

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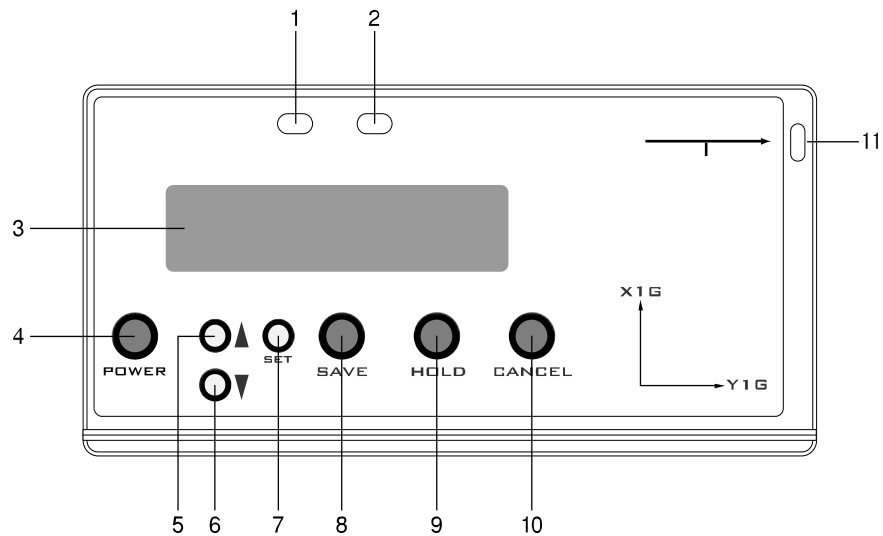
**◆Caution**

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- Close the battery housing lid tightly.
- You can not use GeoClino in water.
- Remove neatly any dust or soil from the rubber packing ring. Take care of the battery housing.  
Water-tight property is reduced when dusted.
- Wipe out cleanly when the device gets wet.
- Open battery housing lid holding the device upside down, when getting wet. Water might have invaded into the housing. If water penetrated into the housing, wipe it out as soon as possible.
- Never shower the device with water containing soap, detergent, bathing chemicals or sea water.

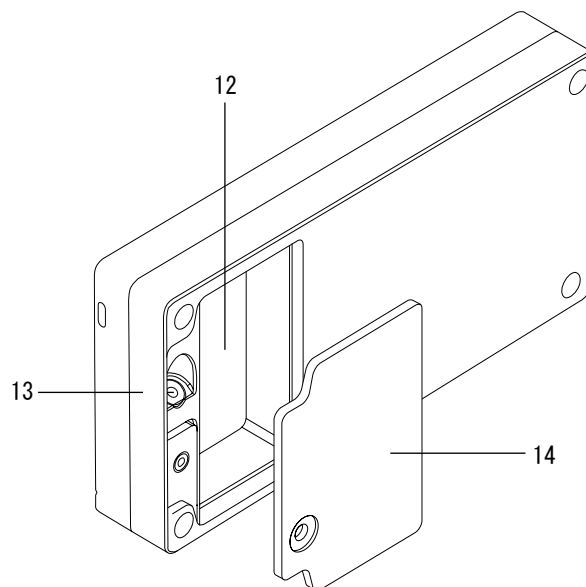
## NAMES OF PARTS

### ◆Main body



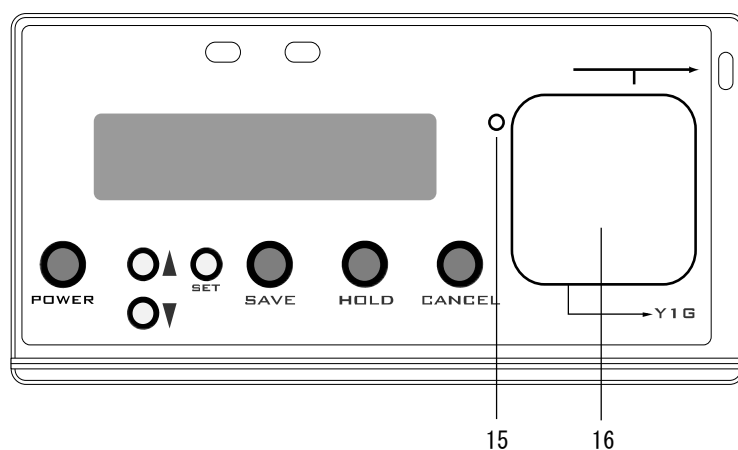
- 1. Battery lamp (red)
- 2. Level lamp (green)
- 3. Display
- 4. POWER button
- 5. UP button
- 6. DOWN button

- 7. SET button
- 8. SAVE button
- 9. HOLD button
- 10. CANCEL button
- 11. Hole for strap



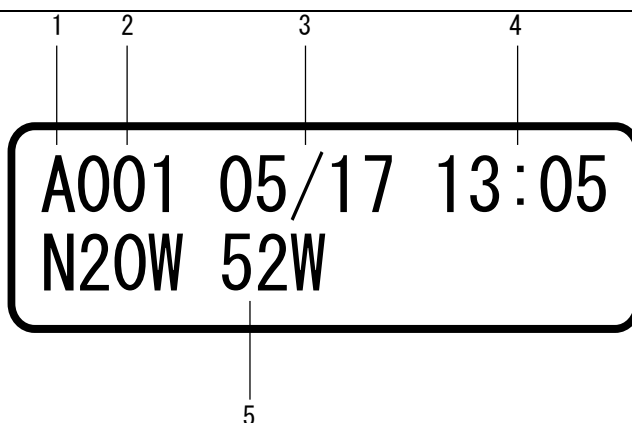
- 12. Battery housing
- 13. Outlet for serial cable

- 14. Battery housing lid



15.GPS lamp (red)      GeoClino-G(GPS compatible) only  
16.GPS antenna

#### ◆Display



1. Mode of measurement	4. Time (Hour : Minute)
2. Number of measurement	5. Data
3. Date (Month/Day)	

## BEFORE USE

### Placing batteries

1. Unscrew the battery housing lid.
2. Place two AA type batteries (1.5V) in correct direction.
3. Close the battery housing lid.

## Life of batteries

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### ★GeoClino

- AA type alkali dry batteries ..... About 20 hours (at 25°C)
- AA type nickel-hydrogen rechargeable dry batteries ..... About 17 hours (at 25°C)

### ★GeoClino-G (GPS receiver built-in)

- AA type alkali dry batteries ..... About 10 hours (at 25°C)
- AA type nickel-hydrogen rechargeable dry batteries ..... About 8 hours (at 25°C)

Red light of the battery lamp (1) suggests the batteries life is expiring. Replace with new batteries.

Life of nickel-hydrogen battery can be shorter.

## POWER-ON AND -OFF

Keep pressing the POWER button (4) for one second to power on. "Welcome" comes up on display.



Welcome

Keep pressing the POWER button (4) for a second to power off.

### ●GeoClino-G (GPS receiver built-in)

After powered on, GeoClino-G starts to receive GPS signals. The GPS lamp (15) remains lighted when signals are received. Where the conditions are good enough, GPS signals can be caught in about 10 seconds. GPS lamp blinks when GPS signals can't be received. Generally GPS signals are not received in the building.

### ◆Automatic power off

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Automatic power-off after about 10 minutes if you do nothing on the GeoClino.

## MODES OF MEASUREMENT

### There are three modes of measurement

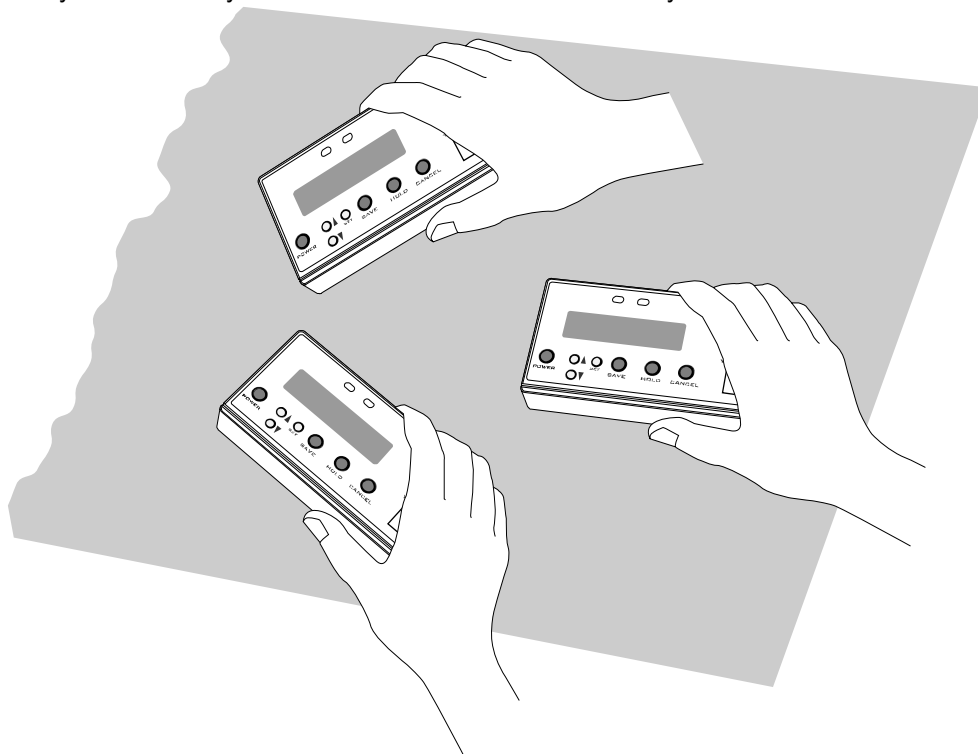
- ① PLANE mode...to measure strike and dip of a bedding plane (or any other surface) automatically by simply placing the GeoClino onto the plane.
- ② LINEATION mode...to measure trend and plunge of a lineation and simultaneously the strike and dip of the plane on which the lineation lies.
- ③ MANUAL mode...to measure orientations of plane and lineation separately, with higher resolution.

### How to use GeoClino in each mode

- First carry out the calibration at the site of measurement.

#### ◆ Measuring in PLANE mode

1. Place the back of GeoClino onto the bedding plane (or else) in any direction. The strike and dip of any surface of any orientation are measured automatically.



2. Measured data come up digitally on display.

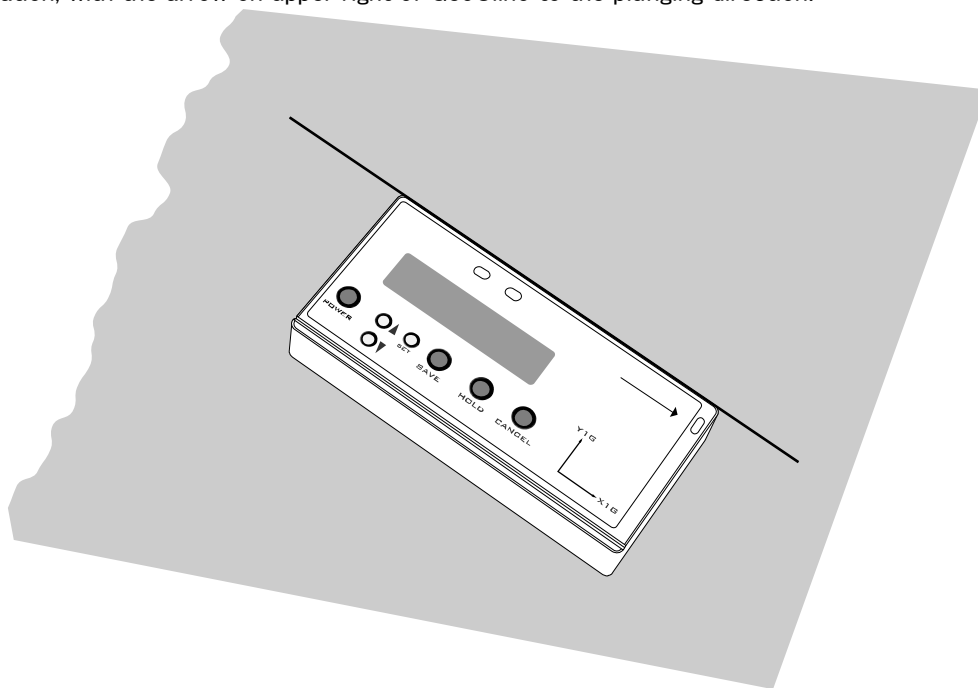
P shows PLANE mode, followed by number of measurement, then date and time in the upper line. Strike and dip on the lower line. Read as “Strike” in N20°W and dip 52° to west, for example, in the Figure below.

P001 05/17 13:05  
N20W 52W

● Accuracy of dip is low in PLANE mode. Use MANUAL mode for higher accuracy.

#### ◆ Measuring in LINEATION mode

1. Place the back of GeoClino on a bedding plane (or else) and align the longer edge onto a lineation, with the arrow on upper right of GeoClino to the plunging direction.



2. Measured data come up on display automatically.

L shows LINEATION mode, followed by number of measurement, then date and time in the upper line. Next come the strike and dip of the bedding plane on which the lineation lies, followed by the trend and plunge of the lineation in the lower line. Read as the plane strikes in N24°E with dip 41° to W, the trend of lineation is N68°W with the plunge of 40° ,for example ,in the Figure below.

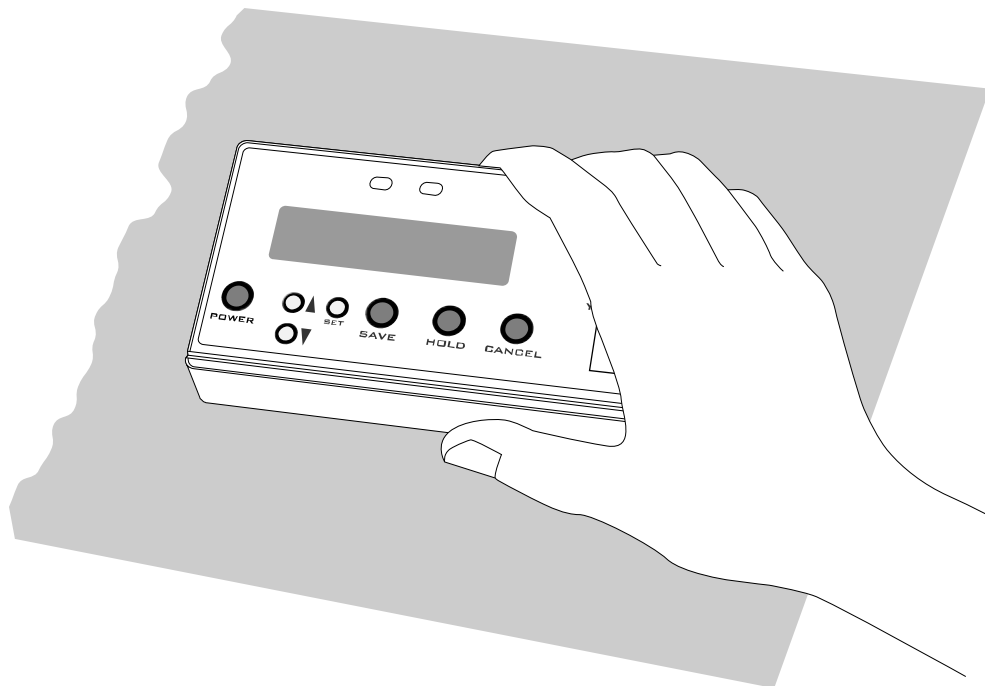
L001 05/17 13:05  
N24E41W N68W40

### ◆Measuring in MANUAL mode

Use this mode to measure strike and dip of a bedding plane (or else), and trend and plunge of a lineation separately.

#### <To measure strike and dip of a plane>

1. Place the back of GeoClino onto the bedding plane.



2. Rotate GeoClino to make the long edge horizontal, keeping the back on the plane, until the plunge becomes zero. Green Level light (2) is turned on when the plunge becomes zero. Strike and dip of the plane are on display.

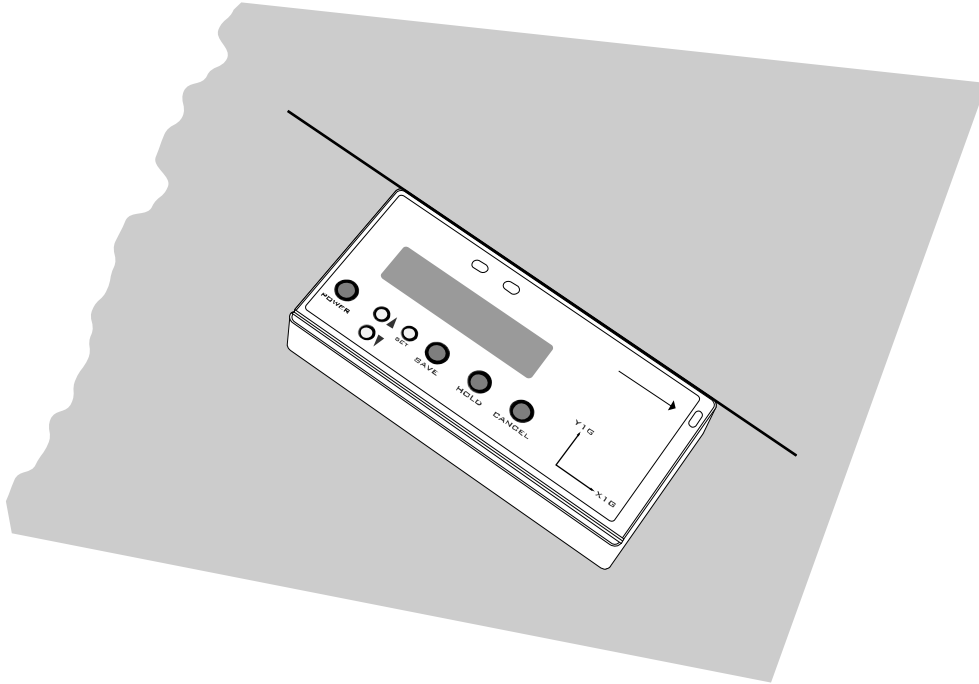
3. On display, M shows MANUAL mode followed by number of measurement, then date and time in the upper line. Strike and dip of the surface in the lower line.

Plunge is of course 0. Read as strike in N34°E and dip 38° to W, for example, in the Figure below.

M001	05/17	13:05
N34W	38W	0

**<To measure trend and plunge of a lineation>**

1. Place the back of GeoClino on the bedding plane (or else). Align the longer edge onto the lineation, with the arrow in the upper right to the plunging direction. Read the data on display.



2. On display, you see M showing MANUAL mode followed by number of measurement, then date and time in the upper line.

In the lower line, you read the trend of the lineation, maximum dip of the plane and plunge of the lineation. Read as the trend of the lineation is N30°W, maximum dip of the plane on which the lineation lies is 72° to W and the plunge of the lineation is 24°, for example, in the Figure below.

M001	05/17	13:05
N30W	72W	24

**Caution**

● Place the longer edge of GeoClino parallel to the lineation holding the arrow to the plunging direction. If you want to measure the upward direction of the lineation (for instance the direction of fault movement), place GeoClino with the arrow to that direction. The plunge angle is shown with minus sign.

● The dip of the overturned plane is shown as “180° – measurement angle”. An overturned plane dipping 30° is shown as 150°.

## Saving the data in memory

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1. Press HOLD button to fix the data of measurements (otherwise the data fluctuate).

P001 A SAV/CANCL  
N37W 40W

2. Press UP or DOWN button to select letters A – Z in the upper line. Selected letter can be used as the mark of the geologic bed you measured.

P001 C SAV/CANCL  
N37W 40W

3. Press SAVE button to save the fixed data. The number of measurement increases by one.

P002 05/17 16:42  
N35W 32W

### ● GeoClino-G (GPS receiver built-in)

1. When pressing SAVE button, GeoClino-G gets GPS data (latitude and longitude).

Now getting  
GPS data...

2. If GeoClino-G received GPS signals (GPS lamp lighted), "Good" sign appears on display, as well as the latitude and longitude data, which are saved automatically in memory.

Good 36° 21.9748N  
140° 28.1793E

3. If GeoClino-G can't catch GPS signals, "Bad" sign appears on display and no data of latitude and longitude appear. However, the data of strike and dip of the surface are saved in memory.

Bad

4. Up to 999 data can be stored in built-in memory. If you press CANCEL button while fixing the data, you get back to the normal measurement mode.

- Data saved in memory are preserved for about 30 days without batteries.
- Data displayed by pressing HOLD button are those obtained in the static state immediately before pressing button, not the data at the time of pressing. There is no problem even if the GeoClino is shaken when pressing HOLD button. See more information in Technical Information pages.

## Checking the data in memory

---

1. Press DOWN button to confirm the data in memory.

P002C05/17 16:42  
N35W 32W

2. Press DOWN button to see the previous data. Press DOWN button once more to see still earlier data. Repeat the same action to see successively earlier data.

P001A05/17 11:54  
N81E 59N

- GeoClino-G(GPS receiver built-in)

The latitude and longitude data are saved when HOLD button is pressed.

P001 36 21.9662N  
Good140 28.1720E

3. Press UP button to see the next data. Press UP button once more to see the following data. Repeat the same action to see successively later data.

4. Press CANCEL button to get back to the normal measurement mode.

## Fixing the alphabet code in memory

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1. Press DOWN button or UP button to display data in memory.

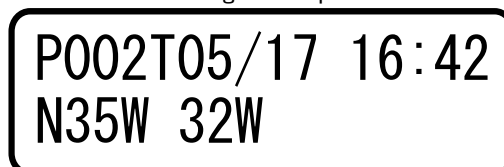
P002C05/17 16:42  
N35W 32W

2. Keep pressing the SAVE button. Then the alphabet code gets blinking.



The alphabet code indicated circle gets blinking.

3. Press DOWN button or UP button to change the alphabet.



4. Press SAVE button to save the alphabet and stop blinking. Press CANCEL button to stop blinking without saving the modification.

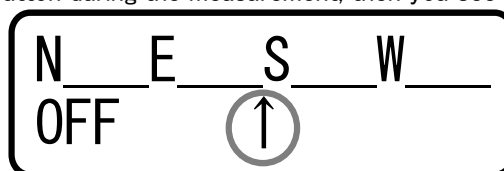
## Simplified direction indicator

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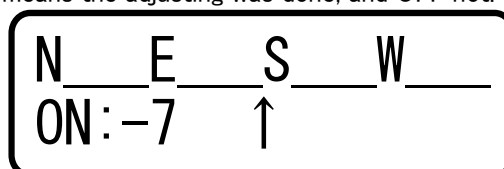
A simplified direction indicator is built in.

If you have adjusted already for the magnetic declination, true direction is shown on display.

1. Keep pressing SAVE button during the measurement, then you see the display as below.



2. Arrow (on display) indicates rough direction you are measuring.
3. OFF or ON in the lower left corner of the display shows whether the magnetic declination was adjusted or not. ON means the adjusting was done, and OFF not.



4. Press CANCEL button to get back to the normal measuring mode.

## Displaying present latitude and longitude. (GeoClino-G only)

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GeoClino-G can display present latitude and longitude.

1. After GeoClino is powered on, keep pressing UP button for a while.

GeoClino-G displays the latitude and longitude of the present location updated at one second intervals.

Good 36° 21. 9748N  
140° 28. 1793E

2. Press CANCEL button to get back to the normal mode.

### ● Examples of sending data

\$GPGSA,A,3,05,06,12,14,18,22,30,,,,,03.2,01.7,02.7\*0F

\$GPGSV,3,1,12,01,21,313,00,05,73,059,47,06,17,156,36,07,14,162,00\*75

\$GPGSV,3,2,12,09,23,069,27,12,51,049,50,14,58,324,38,18,25,188,41\*7A

\$GPGSV,3,3,12,22,46,230,52,30,82,162,49,31,18,274,00,32,43,284,00\*7D

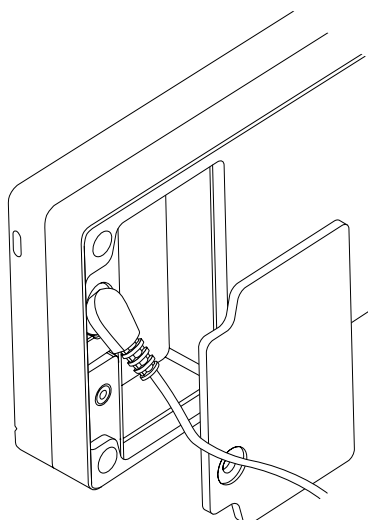
\$GPRMC,021959,A,3621.9751,N,14028.1740,E,000.0,119.0,220807,,,A\*71

\$GPGGA,022000,3621.9751,N,14028.1740,E,1,07,01.7,-00014.0,M,038.1,M,,\*60

## Transferring the data to your computer using GeoAssist software, which comes with GeoClino.

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1. Remove the battery housing lid.
2. Insert the serial cable into the outlet.



3. Connect the other end of the cable to RS232C port of your computer.
4. Start up GeoAssist, then follow the indications.

## SETTING OF MENUS

### Operation in common

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Keep pressing for one second to move to Setting Menu screen.  
Common basic operations are as follows.

1. Keep pressing SET button for a second to get the Setting Menu screen.

▶ 1. MEASURE MODE  
2. CALIB STRIKE

2. Move the cursor by pressing UP or DOWN button, and press either HOLD or SAVE button to show the menu you want.
3. Press CANCEL button to cancel the menu.

### List of Menus

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Menu list is as below.

1. MEASURE MODE .....to switch the mode of measurement.
2. CALIB STRIKE .....to make calibration for precise measurement of strikes.

▶ 1. MEASURE MODE  
2. CALIB STRIKE

3. CALIB DIP .....to make calibration for precise measurement of dips.
4. DECLINATION .....to adjust the device for the magnetic declination.

▶ 3. CALIB DIP  
4. DECLINATION

5. DISPLAY MODE .....to change data format on display.
6. CLEAR MEMORY .....to clear the memory.

▶ 5. DISPLAY MODE  
6. CLEAR MEMORY

7.SET CALENDAR.....to set the date and time.

8.AUTO POWEROFF.....to set the automatic power-on or -off.

▶ 7. SET CALENDAR  
8. AUTO POWEROFF

9. SEND GPS DATA.....to send the data received from GPS (only GeoClino-G)

10.GPS ON/OFF .....to select getting data from GPS (only GeoClino-G)

▶ 9. SEND GPS DATA  
10. GPS ON/OFF

11.AXIS ADJUST .....to adjust the axis of orientation sensor.

▶ 11. AXIS ADJUST

### Switching modes of measurement

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Three modes are available. See “Methods of measurements” and “How to measure in each mode” for details (p. 7). Switching starts from 1.MEASURE mode screen.

Select 1. MEASURE MODE. Press HOLD or SAVE button to move to the screen below. Select the mode you want to use by pressing UP or DOWN button and press SAVE button to change the mode. Press CANCEL button to get back to the current mode.

▶ 1. [PLANE]  
2. [LINEATION]

▶ 3. [MANUAL]

#### [PLANE]

This is the mode in which strike and dip of a plane are measured in a single action, by placing GeoClino onto the plane. The letter A on display shows this mode is acting.

P001 05/17 13:05  
N20W 52W

#### [LINEATION]

This is the mode in which trend and plunge of a lineation are measured in a single action as well as the strike and dip of the plane on which the lineation lies.

The letter L on display shows this mode is acting.

L001 05/17 13:05  
N24E41W N68W40

#### [MANUAL]

This is the mode in which you can measure separately strike and dip of a plane, and trend and plunge of a lineation. See Measuring in MANUAL mode on Page 9. The letter M shows this mode is acting.

M001 05/17 13:05  
N34W 38W 0

## Calibration

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You need to make calibration before using for precise measurements.

Calibration is done on the menu [2. CALIB STRIKE] and [3. CALIB DIP].

- Wait for a minute after power-on until the sensor becomes stable, then carry out calibration.

### ◆ 2. CALIB STRIKE

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Follow the indications below.

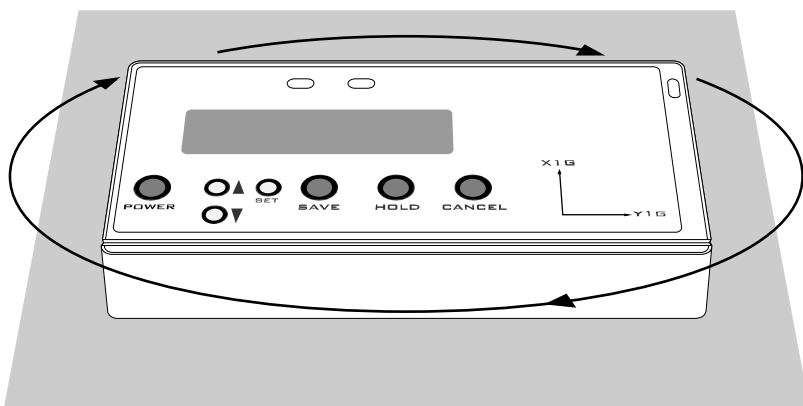
- Carry out calibration before the first measurement on site every day. You do not need to do more than once to keep the calibration throughout that day.
- Never forget to do calibration after you have replaced the batteries.
- Calibration should be carried out in a place where there is no magnetic influence.
- Avoid places for calibration where the temperature is much different from the working place.
- At high latitude (over 60 degrees) the geocline is very touchy about its strike calibration because of the depression. So, please do the strike calibration every 3 hours.

1. Press SAVE button to proceed to the next step. Press CANCEL button to get back to the normal mode.

Calib Strike  
SAVE / CANCEL

2. Hold GeoClino horizontal and press HOLD button.

Then rotate slowly twice (for about 15 seconds) horizontally (in any sense). Press HOLD button.



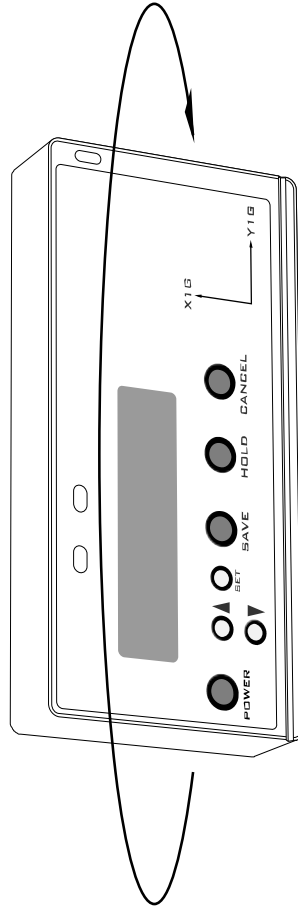
3. You see the display as below. The upper line shows what to do. Strike (in azimuth angle) and maximum dip are shown in the lower line.

Set 0 and 2Rot  
160 0 →HOLD  
Strike Maximum dip

Holding GeoClino horizontal, rotate it until the strike becomes about 0 ( $\pm 10^\circ$ ). Then rotate twice around the axis parallel to the shorter edge. Press HOLD button.

Set 0 and 2Rot  
0 0 →HOLD

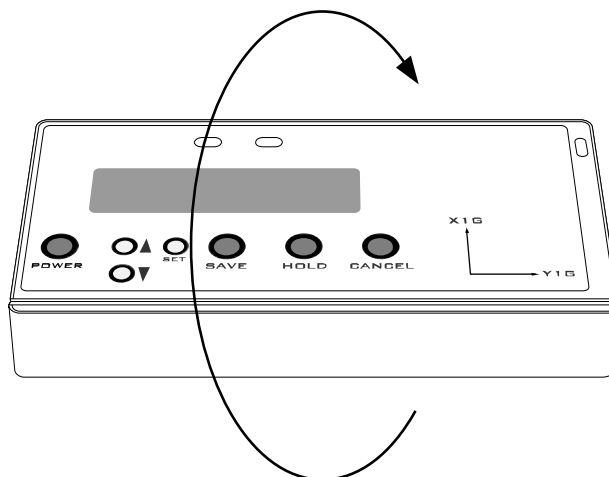
(This value becomes about 0)



4. You see the display as below. Holding GeoClino horizontal, rotate it horizontally to the direction in which the strike becomes about  $90^{\circ}$  ( $\pm 10^{\circ}$ ). Then rotate GeoClino twice around the axis parallel to the longer edge. Press HOLD button to finish.

Set 90 and 2Rot  
 90 0 →HOLD

(This value becomes about 90)



#### ◆ Confirming the calibration

1. Holding GeoClino horizontal, rotate it horizontally to the position in which the strike is directed in N-S (display shows "N0S" in the [NORTH MODE], "0" in the [360° MODE]).
2. Holding GeoClino horizontal, rotate it about  $180^{\circ}$  horizontally and check that the strike becomes about N-S ("N0S" in the [NORTH MODE], "180°" in the [360° MODE]).

#### ◆ 3.CALIB DIP

Follow the following indications.

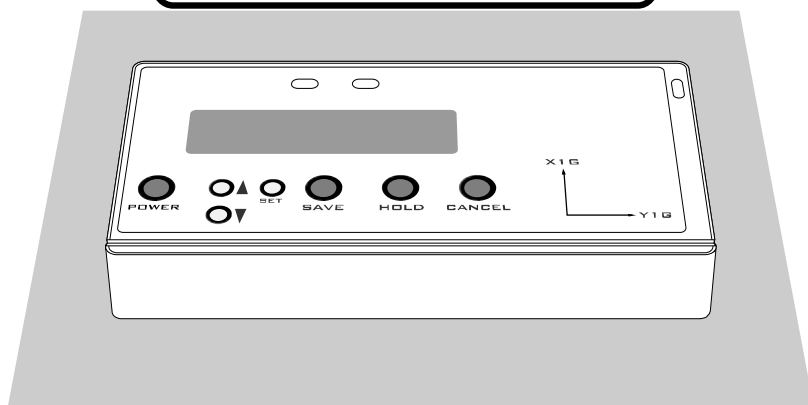
- Carry out calibration in-door, on the horizontal place.
- Avoid a place where the temperature is much different from the working place.
- You only do calibration when the dip seems erroneous. No need to repeat it in different places.

1. Proceed to the next step by pressing SAVE button. To get back to the normal mode, press CANCEL button.

Calib Dip  
 SAVE / CANCEL

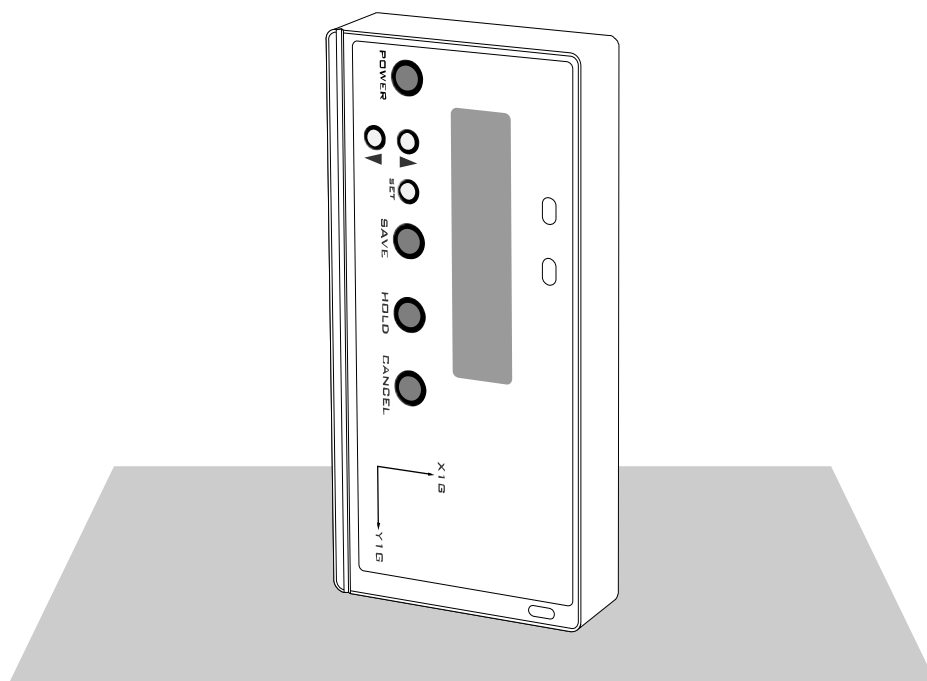
2. You see the display as below. Place GeoClimo on the horizontal plane, with the front side upward. Keep pressing HOLD button until the next message appears on display, or until the green level lamp is lighted.

Put Me Horizontally & Push HOLD



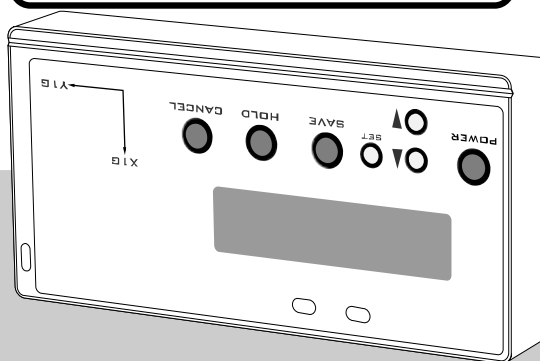
3. You see the display as below. Hold it in the position where the arrow Y1G (\*) (in the lower right of the front side) is vertical, and press HOLD button. Keep pressing it until the green level lamp is lighted.

Put Me Y1G-Position & Push HOLD



4. You see the display as below. Then hold GeoClino in the position where the arrow X1G (\*) is vertical, and press HOLD button. Keep pressing it until the next message appears on display or green level lamp is turned on.

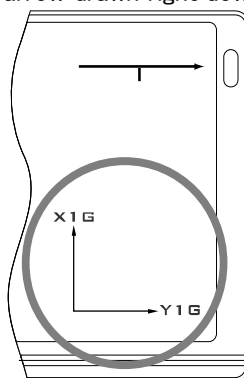
Put Me X1G-Position & Push HOLD



5. Press SAVE button to finish Calibration. Press CANCEL button to get back to the normal mode.

Finished!!  
SAVE / CANCEL

\* The arrow X1G, the arrow Y1G indicate arrow drawn right down at main body.



#### ◆ Confirmation of calibration

1. Place GeoClino horizontally and confirm that the dip shows about 0.

## Other settings

Other settings are described below. First show the setting menu screen, and choose setting you want to do.

### ◆4.DECLINATION

When the magnetic declination angle is entered, adjusted data will be shown on display.

▶ [ON] Value -7  
[OFF]

1. Press UP or DOWN button to move the cursor.
2. If you want to adjust for magnetic declination, put the cursor on ON. If you not, put the cursor on OFF.
3. Holding the cursor on ON, press HOLD button to move the cursor below the already entered angle value. Then you can input the magnetic declination angle.

▶ [ON] Value -7  
[OFF] ▲

4. Press UP or DOWN button to increase or decrease the value. Value to be input ranges from -180 to 180. When the magnetic declination is on W, put the angle in minus figure. For magnetic declination on E, put it in positive figure.
5. Press HOLD button again to clear the cursor. You can select ON or OFF.
6. Press SAVE button to move to the measurement mode you have set up before the calibration. The letter showing the mode is highlighted.

P001 05/25 18:00  
N39W 15W

L001 05/25 18:00  
N39W15W S44E7

M001 05/25 18:00  
N19E 16W 0

## ◆5.DISPLAY MODE

---

In this mode you can change the display format on display. Two formats are available.

▶ [NORTH MODE]  
[360° MODE]

[NORTH MODE]

Strike is shown by bearing from North.

P001 05/17 13:05  
N20W 52W

[360° MODE]

Strike is shown by azimuth angle.

P001 05/17 13:05  
340 52

## ◆6. CLEAR MEMORY

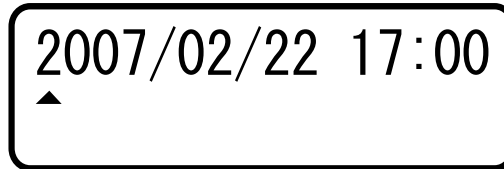
---

▶ [CLEAR]  
[CANCEL]

Press UP or DOWN button to select the action. Put the cursor on [CLEAR] and press SAVE button to clear the memory. Number of measurement is changed to 001. If you put the cursor on [CANCEL] and press SAVE button, you get back to the normal measurement mode, without deleting the content of memory. If you want to move back to normal measurement mode, press CANCEL button.

## ◆7.SET CALENDAR

To set the date and time.



1. Press UP button to increase the figure by 1 indicated by an arrow.
2. Press DOWN button to decrease by 1.
3. Every time you press HOLD button, the arrow shifts to Year → Month → Day → Hour → Minute → Year. You put the correct figure on the selected place.
4. After finished, press SAVE button to save the setting. New dates etc. will appear.
5. If you want to cancel the setting, press CANCEL button. Normal measurement mode will come back.

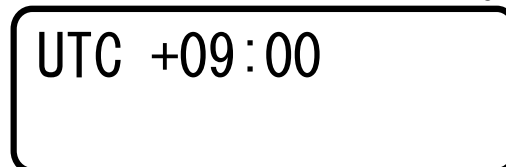
●Range for year setting is from 2000 to 2079.

●GeoClino counts seconds inside. When you press SAVE button to save the setting, second is set back to 0.

### ●GeoClino-G(GPS receiver built-in)

GeoClino-G uses date and time data received from GPS. If it can't receive GPS signals, the data of the built-in clock are used. The built-in clock of GeoClino is synchronized with the time of GPS when signals are received. The time signals from GPS is in UTC (Universal Time Coordinated) so that you should change it to the Japanese standard time.

Time difference between UTC and JST is +09:00. Here is how to adjust time difference.



1. Press UP button to increase time by 15 minutes.
2. Press DOWN button to decrease time by 15 minutes.
3. Press SAVE button to save the setting. The measurement mode will get back to the normal with adjusted time.
4. Press CANCEL button to get back to the normal mode, without saving the adjusted time.

## ◆8.AUTO POWEROFF

You can either activate the Auto Power-off function or inactivate it by setting from this window. Select the action below by putting the cursor and press SAVE button. Press CANCEL button to get back to the normal mode.



[10min]

Auto Power-off runs. If you do nothing on GeoClino, power will be turned off after 10minutes.

[OFF]

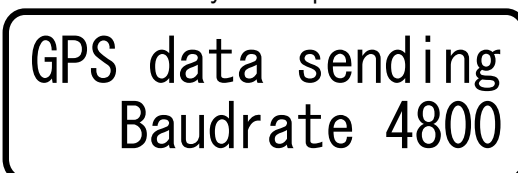
Cancel the Auto Power-off.

## ◆9.SEND GPS DATA (Only GeoClino-G)

GeoClino-G can be used as an ordinary GPS receiver. The data obtained can be transferred to a computer by serial communication. Combined with mapping software, you can make a traverse map or use it as a navigator to your destination.

Communication format is NMEA-0183 (GGA, GSV, GSA, RMC compatible) with Baud rate of 4800bps. See below for procedure.

1. Remove the battery housing lid.
2. Insert the serial cable into the outlet.
3. Connect the other end of the cable to RS232C port of your computer.
4. The data received from GPS are sent to your computer.



5. Press CANCEL button to get back to the normal mode.

### ●Examples of sending data

\$GPGSA,A,3,05,06,12,14,18,22,30,,,,,03.2,01.7,02.7\*0F

\$GPGSV,3,1,12,01,21,313,00,05,73,059,47,06,17,156,36,07,14,162,00\*75

\$GPGSV,3,2,12,09,23,069,27,12,51,049,50,14,58,324,38,18,25,188,41\*7A

\$GPGSV,3,3,12,22,46,230,52,30,82,162,49,31,18,274,00,32,43,284,00\*7D

\$GPRMC,021959,A,3621.9751,N,14028.1740,E,000.0,119.0,220807,,,A\*71

\$GPGGA,022000,3621.9751,N,14028.1740,E,1,07,01.7,-00014.0,M,038.1,M,,\*60

## ◆10.GPS ON/OFF(Only GeoClino-G)

This function can select to get or not GPS data. Using this function, you can reduce the time to measure.

Shortcut Operaton:

At first press “CANCEL Button” in measuring mode. Then keep pressing “CANCEL Button”, and press “SAVE Button”. You can see same display.

▶ 1. [GPS ON]  
2. [GPS OFF]

1.[GPS ON]

You can get data from GPS.

2.[GPS OFF]

You can't get data from GPS.

Press “UP Button” or “DOWN Button” to move the cursor to [1.GPS ON] or [2.GPS OFF], and press “SAVE Button”.

## ◆11.AXIS ADJUST

This is to adjust the accuracy of orientation sensor. It was already done at the time of delivery. No need to do it again except in necessary case.

●The setting of accuracy might be deleted when the power was off for more than one month. In this case you should confirm whether the setting is held or not following the procedure below. Adjusting value is shown on a sticker in the battery housing. If adjusting value is not kept, input it. Or adjust the accuracy following the steps below.

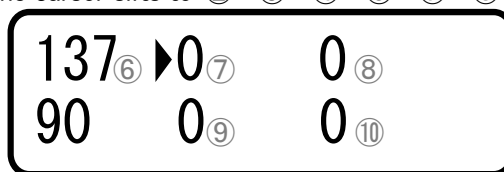
[How to do]

1. Select 9. AXIS ADJUST from the Setting screen. The display appears as below.

137<sup>①</sup> ▶ 0<sup>②</sup> 0<sup>③</sup>  
0 0<sup>④</sup> 0<sup>⑤</sup>

①Azimuth angle(in 360°)	②Adjusting value at N(0°)	③Adjusting value at S(180°)
0(meaning dip 0°)	④Adjusting value at E(90°)	⑤Adjusting value at W (270°)

2. Press HOLD button, the cursor shifts to ②→③→④→⑤→⑦→⑧→⑨→⑩→②.



⑥Azimuth angle(in 360°)	⑦Adjusting value at N(0°)	⑧Adjusting value at S(180°)
90(meaning dip 90°)	⑨Adjusting value at E(90°)	⑩Adjusting value at W (270°)

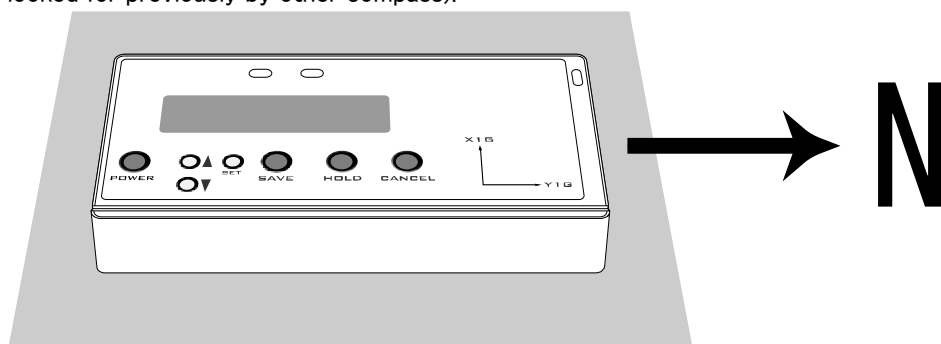
3. Press UP button, then figure indicated by the arrow increases. By pressing DOWN button it decreases.

4. Press SAVE button to indicate the new value. Press CANCEL button to get back to the measurement mode, in ignoring the correction.

[Adjustment procedure]

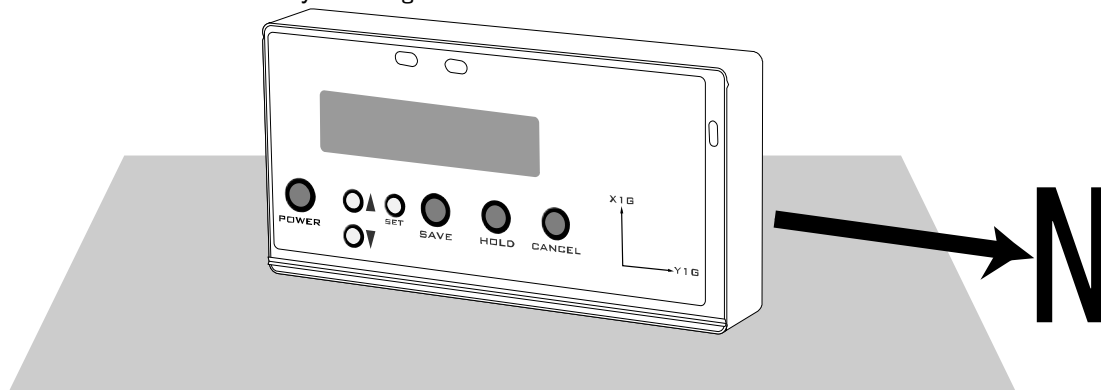
1. Place GeoClino horizontally.

2. Direct the arrow in the upper right of the face of GeoClino toward North (North should be looked for previously by other compass).



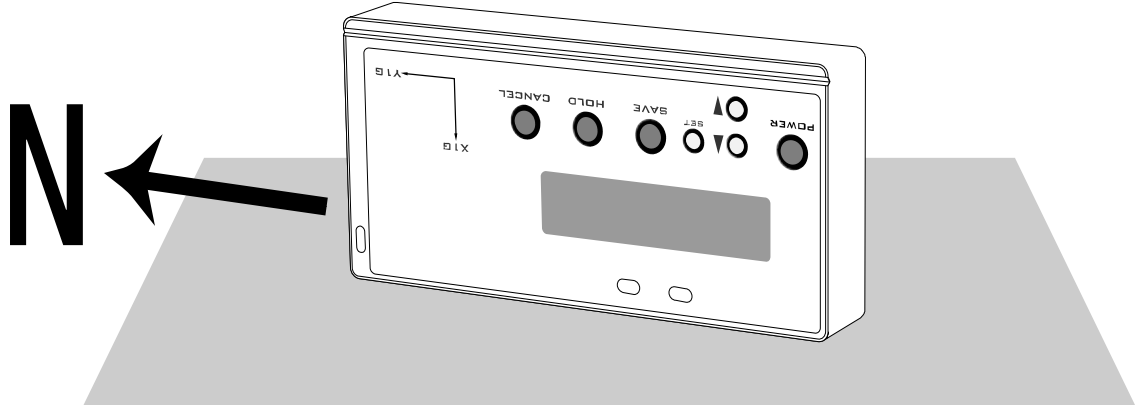
3. Change the value ② to get the value ① to be 0. Similar procedure should be repeated for South, East and West, as follows; Place GeoClino toward South and change the value ③ to get the value ① to be 180; place GeoClino toward East and change the value ④ to get the value ① to be 90; place GeoClino toward West and change the value ⑤ to get the value ① to be 270.

4. Place GeoClino vertically as in Figure and direct the arrow toward North.



5. Change the value ⑦ to get the value ⑥ to be 0. Similarly, placing GeoClio toward South and change value ⑧ to get the value ⑥ to be 180; placing GeoClio toward East, change the value ⑨ to get the value ⑥ to be 90; placing GeoClio toward West, change the value ⑩ to get the value ⑥ to be 270.

6. Place GeoClio vertically as in Figure and direct the arrow to North.



7. Change the value ⑦ to get the value ⑥ to be 0. Similarly, placing GeoClio toward South, change the value ⑧ to get the value ⑥ to be 180; placing GeoClio toward East, change the value ⑩ to get value ⑥ to be 90; placing GeoClio toward West, change the value ⑨ to get the value ⑥ to be 270. Note that the last case is different in procedure from 5.

## TECHNICAL INSTRUCTIONS (COMMUNICATION)

Setting for serial communication, and specifications of command is shown below.

Useful for original application development.

### Setting for communication

Set as below.

Baud rate	9600bps
Data bit	8 bit
Parity	None
Stop bit	1 bit
Flow control	Xon/Xoff (software control)

## List of commands

● Send command when measurement mode is used.

● One sending should be done within 2 msec.

Command	Action	Transmission mode	Remarks
a	Send the data in memory to PC	a	
d	Send the value by acceleration sensor in real time	d	555,572,873 detected values along X-, Y- and Z-axes
e	Send the data detected by magnetic sensor in real time	e	1851,2440,1798 detected values along X-, Y-, Z-axes
o	Send the data in memory to PC	oXXX	data from the last data to those of XXX (three digits) minutes before
h	Stop sending data from sensor	h	
i	Send continuously strike and dip values shown on display to PC	i	strike, dip, plunge, date, time END in 360° mode
j	Send once strike and dip values shown on display to PC	j	strike, dip, plunge, date, time END in 360° mode
v	Show the version number of firmware	v	

## Data format

Formats of data to be sent are cited below.

● Examples of sending data

[NORTH MODE]

1,P,N78W,31S,3,-0-,3,2007-4-3 10:19:57,A,0,-7

2,L,N79W,31S,3,S74E,3,2007-4-3 10:20:3,A,0,-7

3,M,N73W,31S,3,-0-,3,2007-4-3 10:20:11,A,0,-7

END

[360 MODE]

1,P,102,31,3,0,3,2007-4-3 10:19:57,A,0,-7

2,L,101,31,3,106,3,2007-4-3 10:20:3,A,0,-7

3,M,107,31,3,0,3,2007-4-3 10:20:11,A,0,-7

END

[Format]

Number, mode, strike, dip, roll angle (plunge), trend, plunge, year-month-day, hour:minute:second, category, ON or OFF of adjustment of magnetic declination, declination angle correction value.

END

Item	Explanation
Number	1 ~ 999
Mode	P:PLANE, L:LINEATION, M:MANUAL
Strike	
Dip	
Roll angle (plunge)	
Trend	Shown only in LINEATION mode, in other cases, -0- in [NORTHMODE], 0[360 MODE].
Plunge	
Date, Time	
Category	A-Z
ON or OFF	0: Adjusting for declination done; 1: No adjusting
Correction value	Values shown only in the case of ON. 0 in the case of OFF.

●GeoClino-G(GPS receiver built-in)

Data (strike and dip) are sent to PC, addition to longitude and latitude data.

●Examples of sending data

1,P,N48W,16S,15,-0-,15,2007-8-22 15:29:18,A,1,0,A,3621.9679,N,14028.1762,E  
2,P,N5W,4W,4,-0-,4,2007-8-22 15:29:22,A,1,0,A,3621.9822,N,14028.1540,E  
3,P,N10W,5W,4,-0-,4,2007-8-22 15:29:26,A,1,0,A,3621.9800,N,14028.1563,E  
END

[Format]

Number, mode, strike, dip, roll angle (plunge), trend, plunge, year-month-day, hour:minute:second, category, ON or OFF of adjustment of magnetic declination, declination angle correction value, status, latitude, longitude

END

Item	Explanation
Status	A: data of latitude and longitude follow; V: no data of latitude and longitude.
Latitude	Expressed in degree, minute, direction (e.g. 3621.9679,N for 36° 21.9679'N)
Longitude	Expressed in degree, minute, direction (e.g. 14028.1563,E for 140° 28.1563'E)

## TECHNICAL INSTRUCTIONS (FAQ)

The instructions will be given in FAQ style below.

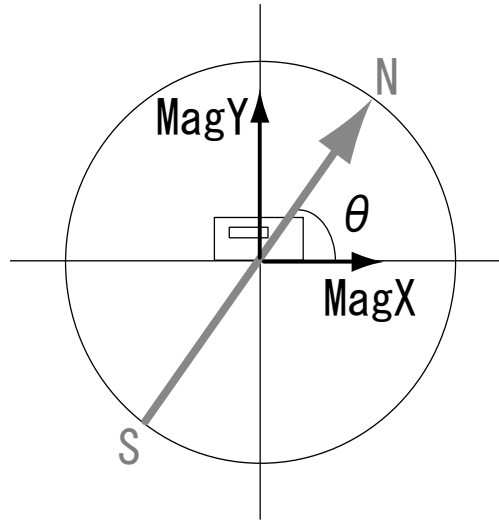
### What is the basic principle of measurement?

Magnetic and acceleration sensors are built in this product. Magnetic sensor calculates the orientation from the detected geomagnetic field. Acceleration sensor calculates the dip from the detected gravitational field. Basic principle of the measurements is as below

◆ **Basic principle of the calculation of orientation by magnetic sensor.**

Grey arrow in the Figure indicates the geomagnetic north. Angle  $\theta$  is calculated from  $\text{MagX}$  and  $\text{MagY}$ , by the equation

$$\tan \theta = \text{MagX} / \text{MagY}.$$

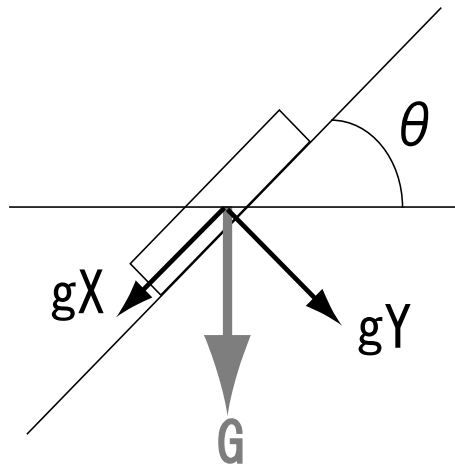


◆ **Basic principle of the calculation of dip by acceleration sensor**

Grey arrow in the Figure shows the gravitational field. Let the gravitational acceleration be  $G$ , detected value along the  $X$ -axis be  $gX$ , that along the  $Y$ -axis be  $gY$ , then the angle to the horizontal plane is calculated by the equation

$$\sin \theta = gX / G$$

$$\cos \theta = gY / G$$



## Explain about the necessity of calibration.

Calibration means adjustment of accuracy of sensors. Brief explanation below.

### ◆ Calibration of magnetic sensor

Let detected value of X-axis component be  $\text{MagX}$ , that of Y-axis be  $\text{MagY}$ . After one horizontal rotation, these two values should make a circle as in the Figure 1 in the ideal case.

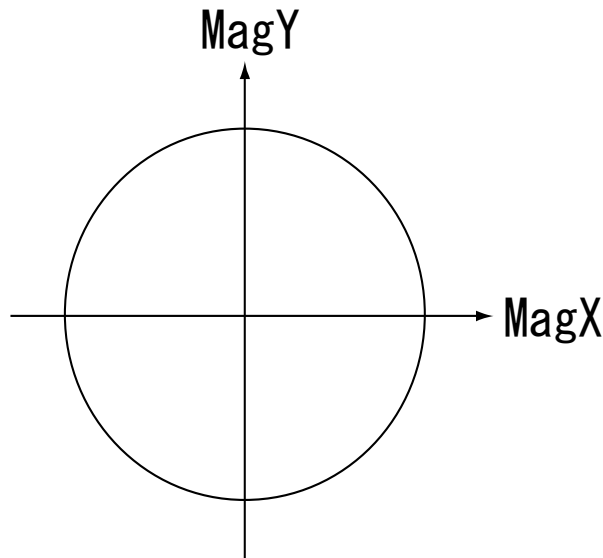


Fig1

However, according to the differences of sensitivity, voltage at the original point, fluctuation of individual sensor, magnetism in the main device and outside magnetic field, etc., both values make a deformed circle as in Figure 2.

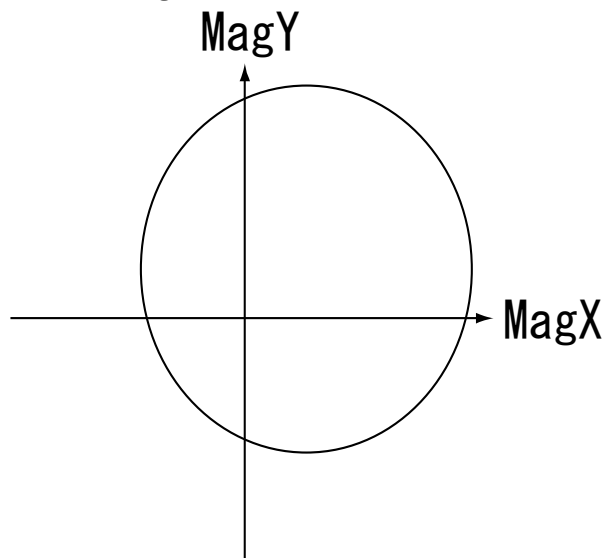


Fig2

In this case correct measurement of the orientation becomes impossible. Then it becomes necessary for the circle to be true circle of which the center should be at the original point (Fig.1).

Calibration includes adjustment of the original point of sensor outcomes, and adjusting of sensitivity of sensor, to let the eccentricity be approximately zero.

Rotating the sensor axes along the geomagnetic orientations enables to get the maximum and minimum values. Intermediate value between these two values is to be the original point for adjusted values. Difference between the maximum and minimum values can give the basis for adjustment of the sensitivity of sensors.

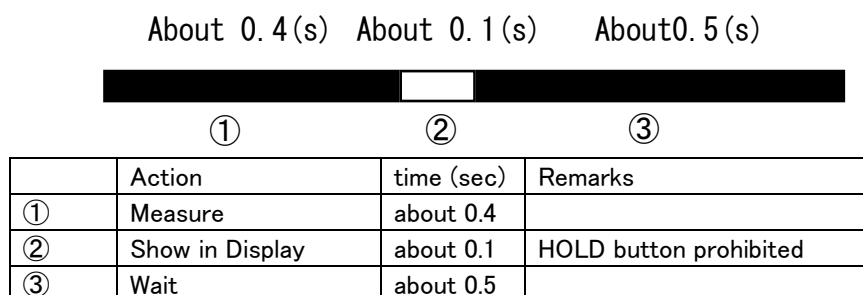
### ◆ Calibration of acceleration sensor

Acceleration sensor needs also to be calibrated, because of the difference of sensitivity, difference of voltage at the original point, and individuality of sensor.

For calibration, gravitational acceleration along every axis should be measured. By directing every axis to the gravitational direction, gravitational acceleration in each axis can be measured. From these data, adjustment of the original point and sensitivity of sensor can be done.

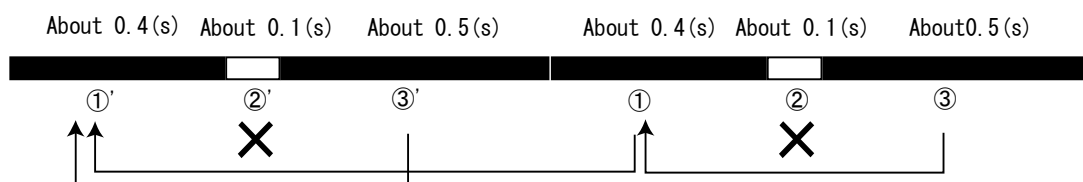
## Does shaking of GeoClino at the time of measurement affect the values obtained?

GeoClino makes the measurements of strike and dip (and others) every one second. When HOLD button is pressed, the displayed values are fixed. Then the displayed values are saved in memory, by pressing SAVE button. After pressing SAVE button, no measurement is carried out. Basically there is no effect of shaking of GeoClino to the values displayed on screen. Process of measurement will be explained in more detail below.



Above measuring sequence ①–③ is repeated. The values on display are fixed instantaneously by pressing HOLD button during the whole sequence. Pressing HOLD button during the action ② does not work.

Action by pressing HOLD button will be as follows. Let the sequence proceed as below.



● When pressing HOLD button in step ①

Values on display are those in step ①', which are values before GeoClino is shaken.

● When pressing HOLD button in step ②

Pressing HOLD button does nothing in step ②, until all the measured values are shown on display.

●When pressing HOLD button in step ③

Values on display are those in step ①, which are values before GeoClino is shaken.

Measurement is designed to prevent any influence from shaking, because the values on display are always taken from the values slightly before the actual measurement.

## IF SOMETHING LOOKS WRONG

Check by yourself when something goes wrong. It may not be a mechanical trouble.

### ◆Power-on unable

Check batteries. Replace with new batteries.

### ◆Buttons do not work

Try followings.

1. Remove batteries.
2. Leave for about 30 seconds.
3. Place batteries. Try power-on.

### ◆Communication with computer does not work

Check the followings.

- Powered on ?
- Is the serial cable firmly inserted into the outlet?
- Is the serial cable firmly connected with computer?
- Setting of the port of the software is good?

## SPECIFICATIONS

### ◆Power source

Two AA type alkali dry batteries, or two nickel-hydrogen rechargeable dry batteries

### ◆Life of batteries (at 25°C)

★GeoClino

About 20 hours (with alkali dry batteries in use)

About 17 hours (with nickel-hydrogen batteries in use)

★GeoClino-G

About 10 hours (with alkali dry batteries in use)

About 8 hours (with nickel-hydrogen batteries in use)

Battery life can be different according to the environment of use.

### ◆Water-tight

JIS 6th class of water protection is adopted.

### ◆Measurable range

Strike 0~359°

Dip -179~179°

Trend        0~359°  
Plunge       -89~89

---

◆Resolution

Strike        1°  
Dip            1°  
Trend        1°  
Plunge        1°

---

◆Interface

★GeoClino, GeoClino-G  
RS232-C serial communication

---

◆Operating temperature

About 0~50°C

---

◆Storage temperature

About -20~+70°C

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◆Dimensions

★GeoClino  
About 142 × 69 × 26mm

★GeoClino-G  
About 142 × 69 × 31mm

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◆Weight

★GeoClino  
About 150 g (excluding batteries)

★GeoClino-G  
About 180 g (excluding batteries)

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◆Packing list

GeoClino, a serial cable specially for GeoClino, CD-ROM, Certificate

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## USER SUPPORT

Address any questions or inquiries to:

GSI Co. Ltd.  
2-8-37 Chuo, Mito, Ibaraki 310-0805, Japan  
Ibaraki Miso Kaikan 2F  
Telephone: 81-29-302-5238; Fax: 81-29-302-5248  
E-mail: [gsi-support@po.gsinet.co.jp](mailto:gsi-support@po.gsinet.co.jp)  
URL: <http://www.gsinet.co.jp>